REMARKS

In view of the above amendments and the following remarks, favorable reconsideration of the outstanding office action is respectfully requested.

Claims 16-19 and 25-39 remain in this application. Claims 1-15 and 20-24 have been canceled. Claims 35 and 37 have been withdrawn from consideration. New claims 40-45 have been added. Applicant believes that no new matter is added to the application as part of this response.

1. Amendments

Claims 16-19 and 25-39 have been rewritten to improve clarity and to ensure antecedent basis.

Claims 16 and 25 have been rewritten to recite that the substrate is not hydrogen loaded. Support for this limitation is found throughout the Examples, as well as at page 3, lines 7-25.

Claim 25 has been rewritten to recite that the core is formed within the interior of the glass body, and that the core is cladded by the composition of the interior of the glass body. Support for this limitation is found throughout the specification as filed, and in FIGS. 9A-9E.

New claims 40 and 41 depend from claims 16 and 25, respectively, and recite that the core is formed at least 1 cm from a surface of the substrate or glass body. Support for this limitation is found in the specification at page 4, line 7.

New claims 42 and 43 depend from claims 16 and 25, respectively, and recite that the thickness of the substrate or glass body is at least one thousand times that of the waveguide core. Support for this limitation is found at page 8, lines 25-28.

New claims 44 and 45 depend from claims 16 and 25, respectively, and recite that the silica-based glass material and the composition of the interior of the glass body is free of germanium. Support for this limitation is found at page 10, lines 22-25.

Please charge the fee under 37 C.F.R. §1.16(c) of $108 for six new claims in excess of twenty to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

2. Claim Rejections - Atkins

The Examiner has rejected claims 16-18 under 35 U.S.C. §102(b) as being anticipated by Atkins (U.S. Patent 5,287,427). The Examiner has rejected claims 19, 25, 27, 28 and 31 under 35 U.S.C. §103(a) as being unpatentable over Atkins. The Examiner has rejected claim 39 as being unpatentable over Atkins alone, or in view of Hunter (U.S. Patent 5,999,672).

Claim 16 has been rewritten to recite that the substrate is not hydrogen loaded. Claims 17 and 18 depend from claim 16, and therefore now include the same limitation. Claim 25 has been rewritten to recite that the glass body is not hydrogen loaded. Claims 27 and 31 depend from claim 25, and therefore now include the same limitation. In Atkins, the index change upon exposure requires the presence of hydrogen in the glass material. The hydrogen is loaded into the gas at high pressure and moderate temperature. In the present invention as described in the specification and recited in claims 16 and 25, the step of hydrogen loading is not necessary; the index change is due to UV-induced densification of the material, and not due to any H_2-mediated reaction. Applicant submits that, since Atkins requires hydrogen loading, it does not anticipate rewritten claims 16-18, 25, 27 and 31.

Claim 19 depends from claim 16. For the reasons stated above, Applicant submits that claim 19 is not unpatentable over Atkins.

Claim 28 has been rewritten to recite that the first core path, the second core path, and the third core path are all formed in the same glass body. The Examiner has suggested that the process of Atkins be repeated many times in order to make many waveguides, with the motivation being to make more money. The Examiner comments that it would have been obvious to stack individual waveguides, and asserts that such a stacking (with or without packaging) would result in three different claims. As rewritten, claim 28 requires that all three core paths be formed in the same glass body. Applicant submits that the Examiner's suggested stacking of individual devices does not teach or suggest the formation of multiple waveguides in different planes in a single glass body, and that claim 28 as rewritten is not unpatentable over Atkins.

Claim 39 has been rewritten to more particularly point out that the method of claim 25 is used to make the wavelength division multiplexer. For the reasons stated above in relation to claim 25, Applicant submits that claim 39 is not unpatentable over Atkins, or over Atkins in view of Hunter.

3. Claim Rejections - Cocito

The Examiner has rejected claims 25, 29, 30 and 34 under 35 U.S.C. §102(e) as being anticipated by Cocito (U.S. Patent 6,209,356). The Examiner has rejected claims 26, 31-33, 36 and 38 under 35 U.S.C §103(a) as being unpatentable over Cocito.

Claim 25 recites that the interior of the glass body has a homogeneous composition, that the core is formed within the interior of the glass body, and that the core is cladded by the composition of the interior of the glass body. In Cocito, a strut of higher refractive index is written through the core of an optical fiber with UV radiation in order to provide a polarization-maintaining fiber. If both the core and the cladding of Cocito's fiber are taken together to be the 'interior of the glass body' of claim 25, then the interior of the glass body does not have a homogeneous composition. Alternatively, if only the core of Cocito's fiber is taken to be the 'interior of the glass body', then the raised refractive index region is not cladded by the interior of the glass body; on two sides, it is clad by the cladding layer of the fiber, which is not part of the 'interior of the glass body.' In either event, the raised refractive index regions formed in the optical fiber of Cocito are not waveguiding cores, as required by claim 25; rather, they are raised refractive index features created to form a desired degree of anisotropy in the optical fiber core. As such, Applicant submits that Cocito does not meet each and every limitation of claim 25, and that claim 25 is therefore not anticipated by Cocito.

Claims 29, 30 and 34 depend from claim 25, and include each and every limitation of claim 25. For the reasons described above in relation to claim 25, Applicant submits that claims 29, 30, and 34 are likewise not anticipated by Cocito.

Claims 26, 31-33, 36 and 38 depend from claim 25, and include each and every limitation of claim 25. Since claim 25 as rewritten is believed to be patentable as described above, Applicant submits that claims 26, 31-33, 36 and 38 are not unpatentable over Cocito.

4. New Claims

New claims 40 and 41 recite that the waveguide core is at least 1 cm away from each surface of the substrate and of the glass body, respectively. In Cocito, the optical fiber appears to be a conventional optical fiber, having an uncoated diameter of ~125 μm. In Atkins, the substrate is only about 2 mm thick.

New claims 42 and 43 recite respectively that the thickness of the substrate and of the glass body are greater than one thousand times the thickness of the waveguide core. In Cocito, the raised refractive index features formed by the irradiation are not waveguiding cores. Regardless, the raised refractive index features formed in Cocito are about as thick as the core (about 8 μm). The fiber appears to be conventional optical fiber, which has an uncoated diameter of ~125 μm. In Atkins, a multimode waveguide is written in a 2 mm thick slab of hydrogen-loaded glass; the thickness of the core is not specified, but for the index changes achieved in Atkins, it must be much greater than 2 μm to provide multimode waveguiding.

Claims 44 and 45 depend from claims 16 and 25, respectively, and recite that the silica-based glass material and the composition of the interior of the glass body is free of germanium. In Cocito, the core of the optical fiber is germanium doped; it is the interaction of the germanium doped core with the UV radiation that causes the index change. In Atkins, the germanium is necessary to give an index change with hydrogen loading (see col. 4, lines 3-31).

5. Conclusion

Based upon the above amendments, remarks, and papers of record, Applicant believes the pending claims 16-19 and 25-39 of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests reconsideration of the pending claims and a prompt Notice of Allowance thereon.

Applicant believes that no extension of time is necessary to make this Response timely. Should Applicant be in error, Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. §1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to James V. Suggs at 607/974-3606.

Respectfully submitted,

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CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8: I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Asst. Commissioner of Patents and Trademarks, Washington, D.C. 20231 on 3-19-03
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Signature

3-19-03
Date of Signature

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Claims 16-19 and 25-39 have been amended as follows. Claims 40-45 have been added as follows:

16. (once amended) A method of writing a light guiding structure comprising the steps of:

[selecting a silica-based] providing a bulk glass substrate formed from a silica-based material, the substrate not being hydrogen loaded; and

focusing a beam output from a below 300 nm laser within said substrate while translating the [focus] focused beam relative to the substrate along a scan path at a scan speed effective to densify and induce an increase in the refractive index of the material along the scan path relative to that of the unexposed material while incurring substantially no laser induced breakdown of the material along the scan path,

thereby forming an optical waveguide having a core formed from the densified material; and a cladding surrounding the core, the cladding being formed from the silica based material[said induced increased refractive index scan path comprising an optical waveguide core formed within the bulk glass substrate material with the unexposed material outside of the scan path focus providing an optical waveguide cladding surrounding said formed core].

17. (once amended) A method as claimed in claim 16, wherein [selecting] said [silica-based] bulk glass substrate [material includes selecting a glass with] has a substantially homogenous composition.

18. (once amended) A method as claimed in claim 16, wherein [selecting] said [silica-based] bulk glass substrate [material includes selecting a glass with] has a substantially homogenous refractive index.

19. (once amended) A method as claimed in claim 18 wherein said [selected] bulk glass substrate has an optical index homogeneity of $\Delta n \leq 5$ ppm.

25. (once amended) A method of making a three dimensional structure within an interior of a glass body, said method comprising the steps of:

providing a glass body, said glass body having an interior, said interior having a homogeneous composition and refractive index, said glass body not being hydrogen loaded,

providing a laser beam and a [lense] lens,

coupling said laser beam into said [lense] lens to form a converging focused laser beam having [a] an intensity at its [refractive index increasing] focus sufficient to increase the refractive index of the composition of the interior of the glass body, and

positioning said focus inside said glass body interior and controlling relative motion between said focus and said glass body, [wherein said focus forms]

thereby forming a raised refractive index waveguiding core within the interior of said glass body, said raised refractive index waveguiding core [for guiding light and] being cladded by the composition of the interior of said glass body.

26. (once amended) A method as claimed in claim 25, wherein said glass body [having] has a first exterior side and a second exterior side, said first exterior side lying in a first plane, said second exterior side lying in a second plane, said second plane being non-parallel to said first plane, wherein said waveguiding core traverses the glass body from an input at said first exterior side to an output at said second exterior side.

27. (once amended) A method as claimed in claim 25, said glass body having a planar exterior base side, wherein said waveguiding core [tunnels] traverses the glass body in a plane non-parallel to said planar base side.

28. (once amended) A method as claimed in claim 25, wherein said method [including] includes forming a first raised refractive index waveguiding densified core path in the glass body, a second raised refractive index waveguiding densified core path in the glass body, and a third raised refractive index waveguiding densified core path in the glass

body, wherein said third core is in a plane separate from said first core and said second core.

29. (once amended) A method as claimed in claim 25, wherein said [providing a glass body including providing a glass] composition is homogeneously doped with a glass softening dopant.

30. (once amended) A method as claimed in claim 25, wherein said [providing a] interior of said glass body [including providing a glass with] has an index homogeneity of $\Delta n \leq 5$ ppm.

31. (once amended) A method as claimed in claim 25, wherein said laser beam [having] has a wavelength λ_{Laser}, and said glass body [having] has an internal transmission of at least 50%/cm at λ_{Laser}.

32. (once amended) A method as claimed in claim 25, wherein [said focus forms a refractive index increase of] the difference between the refractive index of the waveguiding core and the refractive index of the unexposed interior of the glass body is at least 1 X 10^{-5} at 633 nm.

33. (once amended) A method as claimed in claim 25, wherein [said focus forms a refractive index increase of] the difference between the refractive index of the waveguiding core and the refractive index of the unexposed interior of the glass body is at least 1 X 10^{-4} at 633 nm.

34. (once amended) A method as claimed in claim 25, wherein [providing a] the laser beam [includes providing] is output from an excimer laser.

35. (once amended) A method as claimed in claim 25, wherein [providing a] the laser beam [includes providing] is output from a solid state laser.

36. (once amended) A method as claimed in claim 25, wherein [providing a] the laser beam [includes providing] is output from a 193nm excimer laser.

37. (once amended) A method as claimed in claim 25, wherein [providing a] the laser beam [includes providing] is output from a 248nm excimer laser.

38. (once amended) A method as claimed in claim 25, wherein said method [including] includes forming a first raised refractive index waveguiding densified core in the glass body and a second raised refractive index waveguiding densified core in the glass body, wherein [guided light is coupled from] said first core is optically coupled to said second core.

39. (once amended) [A method as claimed in claim 25, wherein said method includes] A method for forming a wavelength division multiplexer for multiplexing a plurality of optical wavelength channels, said [forming] method including the steps of:

forming using the method of claim 25 a plurality of waveguiding core inputs in the glass body for separately inputting the plurality of optical wavelength channels,

forming using the method of claim 25 a multiplexing region for multiplexing said inputted channels, and

forming using the method of claim 25 an output waveguiding core for outputting said multiplexed input channels.

40. (new claim) A method as claimed in claim 16, wherein the core of the optical waveguide is at least 1 cm from each surface of the substrate.

41. (new claim) A method as claimed in claim 25, wherein the core of the waveguide is at least 1 cm from each surface of the glass body.

42. (new claim) A method as claimed in claim 16, wherein the substrate has a thickness at least one thousand times the thickness of the core of the optical waveguide.

43. (new claim) A method as claimed in claim 25, wherein the glass body has a thickness at least one thousand times the thickness of the core of the waveguide.

44. (new claim) A method as claimed in claim 16, wherein the silica-based glass is free of germanium.

45. (new claim) A method as claimed in claim 25, wherein the composition of the interior of the glass body is free of germanium